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ABSTRACT

A project was conducted to identify and collect software, hardware, and print materials to enable vocational teachers to use computers with handicapped students; to conduct a series of workshops emphasizing hands-on experiences with computer hardware and software; and to design a booklet describing research and resource materials for these teachers. Letters were sent out to area vocational-technical schools and to local intermediate units requesting information on how computers were being used with handicapped students. Site visits were made to vocational schools with computer programs for special students that were identified as being successful. After conducting a survey to identify available software, appropriate software and print materials describing computer usage in general and by disabled persons in particular were ordered. A series of three one-hour workshops dealing with using computer hardware and software were presented for vocational educators. A booklet describing computer literacy, computer hardware, and software and containing an annotated bibliography of collected print materials was prepared and distributed to the workshop participants. (This project report includes the computer literacy booklet, a summary of responses to an exit evaluation of the workshops, a glossary, transparency masters dealing with floppy disks and the inner workings of a computer, brief sample programs, a selected bibliography, a list of catalogs of computer software and books, software and courseware evaluation forms, and sample exercises.) (MN)

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Abstract

Contract Number 86-4005

Computer Literacy for Vocational Teachers of the Handicapped

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$33,721.00
7/1/83 - 6/30/84

The objectives of this project were to identify and collect software, hardware and print materials to enable vocational teachers to use computers with handicapped students, to conduct a series of workshops emphasizing hands-on experiences with computer hardware and software, and to design a booklet which describes research and resource materials for these teachers.

Objectives

1. To develop/identify software and adaptive materials/procedures to enable handicapped vocational students to use computers efficiently and effectively (for remedial and developmental purposes).
2. To plan and conduct computer-literacy workshops that will introduce and/or upgrade microcomputer usage skills of vocational teachers of the handicapped.
3. To assist vocational teachers of the handicapped to incorporate computer-assisted instruction and computer usage into their curricula.
4. To develop and field test (through these workshop participants) a booklet describing handicapping conditions of students and how to incorporate the microcomputer in the classroom as a tool for assisting in remedial as well as developmental and occupational skills.

Outcomes

1. Letters were sent to area vocational-technical schools and to local intermediate units requesting information on how computers were being used with handicapped students. Other letters were sent to faculty, especially those in Special Education and Rehabilitation asking if they knew of exemplary programs.
2. Visits were made to several vocational schools where programs for special students were identified as being successful.
3. The project consultant also attended one state and several national conferences concerned with the uses of computers in schools.
4. A survey was made of software which was available through the School of Education's Learning Resource Center. Additional software was ordered.
5. Print materials describing computer usage in general and usage with handicapped persons in particular as well as evaluations of hardware and software was ordered.
6. A series of three (3) hour workshops was planned and presented for vocational educators. (Six workshops, three three-hour sessions each.)
7. A printed booklet describing computer literacy, computer hardware and software and containing an annotated bibliography of collected print materials was prepared and distributed to workshop participants and vocational educators.

Audience

The workshops were conducted for vocational educators. The booklets will reach a wider audience of vocational teachers, supervisors, and administrators as well as colleagues at the University who have indicated interest.

Published Materials

500 Booklets
Final Report

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I. BACKGROUND

Computer literacy is essential for all persons if they are to function competently in our information based society. United States Labor Department data shows that information industries make up 49 percent of our national effort (Henriques, 1982). Educational Testing Service (E.T.S.), in defining "computer literacy", emphasized the ability to use computers for learning and information management, a knowledge of how computers function, and the understanding needed to evaluate new applications as they arise (E.T.S., 1984, p. 9).

The computer has the potential for enabling handicapped persons to become self sufficient and self supporting. The Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped lists over a hundred such adaptations. Several of those described are being used in the Pittsburgh area: one at the Rehabilitation Institute of Pittsburgh and another at the Western Pennsylvania School for the Deaf.

Because the computer is a patient tutor and can provide immediate feedback, it has been successfully used with learning disabled students. Learning Disabled Students and Computers: A Teacher's Guide Book describes characteristics of these students and ways in which the computer can be used to tutor, as a word processor, and to program in a language such as LOGO.

Research on use of computers in schools is relatively scarce because the large scale use of microcomputers is a recent event. Previously it was impossible to find numbers of students who had computing experience. Also, Maddux (1984) believes that researchers lack expertise in this area. Therefore, most studies have either been like Becker's (1983)

in which questionnaires were sent to a random sample of the nation's schools to determine microcomputer availability and usage or were case studies of individual students (Goldenburg, 1983; Weir et al, 1982; Trachtman, 1984; Marquis, 1984). In most instances the individuals studied in depth were handicapped.

McLaughlin's (1984) study for the American Institute for Research (AIR) of how teachers utilized interactive videodiscs points up another problem. The software for educational use is not yet available for this advanced technology, and teachers lack the time and expertise to design it. Therefore, while the interactive videodisc has great potential for use by handicapped persons, it will probably not be used in schools until either more educational courseware is designed or business and industry share their training materials with vocational schools. Recent articles in Electronic Learning, April, 1984, (St. Lawrence, Reinhold) present the argument that the future looks brighter and describes some successes with deaf children at the California School for the Deaf in Riverside California which participated in McLaughlin's AIR study.

References

Becker, J. J. School uses of microcomputers. Baltimore, Maryland: The Johns Hopkins University, 1983.

Goldenberg, E. P. Special technology for special children. Baltimore, MD: University Park Press, 1983.

The Institute of Electrical and Electronics Engineers, Inc. Proceedings of the Johns Hopkins first national search for applications of personal computing to aid the handicapped. Piscataway, New Jersey: IEEE, 1981.

Maddox, C. D. Educational Microcomputing: The need for research Computers in the Schools, Spring 1984, (1), 35-41.

Marquis, J. G. Microcomputer usage by a low vision student: a case study. Paper presented at the American Educational Research Association Annual meeting, New Orleans, April 1984.

McLaughlin, D. H. Teachers' use of technology: experiences of the videodisc/microcomputer network. Paper presented at the American Education Research Association Annual Meeting, New Orleans. April 1984.

Metzger, M., Ouellette, D., & Thormann, J. Learning disabled students and computers: a teacher's guide book. Eugene, Oregon: International Council for Computers in Education, 1983.

Trachtman, P. Putting computers into the hands of children without language. Smithsonian, February 1984, 14 (11), 42-51.

Weir, S., Russell, S. J., & Valente, J. A. LOGO: an approach to educating disabled children. BYTE, 1982, 7 (9), 342-360.

II. PURPOSE

The University of Pittsburgh Department of Education conducted six workshops (each consisting of a series of three three-hour sessions) for vocational teachers of the handicapped: Computer Literacy for Vocational Teachers of the Handicapped. These workshops emphasized hands-on experience with microcomputers, as well as supportive narrative and printed materials including a booklet developed to incorporate information and strategies for computer utilization in the vocational instruction of handicapped students.

Objectives

The objectives of the project were:

1.0 To develop/identify software and adaptive materials/procedures to enable handicapped vocational students to use computers efficiently and effectively (for remedial and developmental purposes).

2.0 To plan and conduct computer-literacy workshops that will introduce and/or upgrade microcomputer usage skills of vocational teachers of the handicapped.

3.0 To assist vocational teachers of the handicapped to incorporate computer-assisted instruction and computer usage into their curricula.

4.0 To develop and field test (through these workshop participants)

a booklet describing handicapping conditions of students and how to incorporate the microcomputer in the classroom as a tool for assisting in remedial as well as developmental and occupational skills.

III. PROCEDURES

Vocational-technical schools and intermediate units in the area were contacted by mail to determine how they were using computers with handicapped students. The faculty in the Department of Special Education and the Rehabilitation Counseling Program, University of Pittsburgh, were also surveyed to determine how they used computers with special students. (Appendix A) A computer search was run to find research relevant to the project. The results of these processes were:

1. Those persons from vocational schools who responded to the letters of inquiry indicated that computers were used in the same way with handicapped and non-handicapped students.
2. Colleagues in Special Education shared information about how computers were used in special schools.
3. A search failed to identify research on using computers with handicapped; however, recent issues of computer magazines were devoted to the topic and yielded much information.

The workshops were designed to provide information about computers as well as hands-on experiences. Workshop participants programmed a speech synthesizer and a graphics tablet and worked with the BASIC and LOGO programming languages. A variety of software was obtained from the School of Education's Learning Resource Center and the Vocational Education Department.

The first session (of each workshop of the series) consisted of a slide presentation which traced the history of computers, illustrated the effects of miniaturization on computer size and performance, and

showed how computers process information. The hands-on session emphasized using different microcomputers to run simulations and programming using the LOGO language.

Session Two discussed software and hardware evaluations and emphasized the need to first identify where the computer can contribute to the instructional program, then find appropriate software and, lastly, find hardware which will run software. The hands-on session instructed participants on the use of a speech synthesizer and a graphics tablet as well as a variety of software packages.

Session Three emphasized the use of computers with students having a variety of handicaps. Studies were cited and sources identified. A handout encouraged participants to program the microcomputers to discover how information is processed. The hands-on session was very flexible. Participants could run software or type in prepared programs and run them. (Appendices B-G)

Fifty-five educators attended the six workshop series. Evaluations indicated participants were extremely positive concerning the organization, objectives, presenter, presentations, hands-on activities and handouts. Suggestions for future workshops included more hands-on time (more than three sessions), a greater variety of software, and, in the case of the larger sessions, a smaller student-instructor ratio.

A sample of the booklet developed for this project is included as Appendix H. (The booklet was developed by project staff and edited for clarity by a research specialist, Dr. Allen Berger, Professor, Instructional Studies, University of Pittsburgh.) It includes an annotated bibliography of software and hardware evaluations and procedures for adapting computers for various handicapping conditions.

IV. ANALYSIS

This project attempted to acquaint practitioners in the field with ways in which computers can be used in classrooms, with an emphasis on adaptations for handicapped students. Workshops stressed presentations on the history of computers, how computers process information, evaluations of software and hardware, and adaptations for various handicapping conditions. Participants worked with a variety of computer hardware and courseware including a speech synthesizer and a graphics tablet. Articles on videodisc technology and its possible use in vocational education were also discussed.

The booklet was designed to help vocational educators use computer hardware and software with hardicapped students. An annotated bibliography gives references where additional information can be found. The workshops emphasized hands-on experiences with a variety of microcomputers and courseware. Workshops sessions were evaluated by participants at the conclusion of the third meeting. (See form in Appendix I) The majority of particiapnts had no previous computer experience and they were very enthusiastic about developing the ability to boot-up disks and to type in and run simple programs.

Print materials evaluating software and hardware for use with specific handicaps were used by workshop participants at each session. Appendix J contains for a bibliography of these materials. In addition, magazine articles from a variety of computing publications were shared. Participants also shared their own experiences with students. In most instances, the students with whom they worked needed remedial materials. A shortage of microcomputer software and hardware in classrooms was a prevailing problem reported by participants.

V. CONCLUSIONS AND RECOMMENDATIONS

The written evaluations for the workshops as well as verbal feedback to the instructor were extremely positive. Participants requested additional sessions in the future. The materials collected and the handouts were enthusiastically received.

Problems were encountered in scheduling the computer lab because it is used many evenings for School of Education programming courses. Also, most of the software that was collected ran on the Apple microcomputers, while the lab includes mostly TRS-80 Model III machines. A third problem is the lack of microcomputers in the local schools.

The booklet should be helpful to vocational educators seeking ways to use microcomputers with handicapped students. The annotated bibliography suggests materials which will give specific information. The best sources of information on computers are magazines such as BYTE, Popular Computing, etc., because the articles reflect current trends.

A persistent problem is that of reaching larger numbers of teachers. Some participants traveled over an hour each way to attend sessions. Perhaps, in the future, similar workshops could be offered in centrally located schools rather than at the University.

VI DISSEMINATION

Five hundred booklets were printed for distribution to vocational educators in Pennsylvania through:

Pennsylvania Bureau of Vocational Education

Vocational Education Department of the University of Pittsburgh

APPENDICES

Summary of Responses
Exit Evaluation
Vocational Education Computer Literacy Workshops

Previous Level of Computer Literacy: 48% None
33% Some
18% High

Area of Presentation	Effectiveness					
	5	4	3	2	1	No Response
	%	%	%	%	%	
1. The organization was:	33	58	6	3	0	0
	Excellent					Poor
2. The objectives of the workshop were:	42	42	15	0	0	0
	Clearly Evident					Vague
3. The presenter was:	45	45	9	0	0	0
	Excellent					Poor
4. The presentations were:	33	55	12	0	0	0
	Very Informative				Not Helpful	
5. The hands-on activities were	33	55	9	0	3	0
	Very Interesting					Dull
6. The handouts were:	42	55	3	0	0	0
	Very Helpful				No Benefit	

Summarize what you consider to have been the strengths of these workshops.

Good start and good basic introduction.

The introduction was very good.

I entered the workshop with virtually no knowledge of comupters - I left with some knowledge and a wealth of resource information where I can receive more knowledge. (Continued on next page.)

Suggestions made for changing future workshops.

Keep weather nice.

More time on the machines and more software programs.

It would be helpful to have a little program prepared for people to type into. (Similiar to your questionnaire on outputs.)

(Continued on next page.)

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Summarization of strenghts continued.

Exposure to various sources of software. Sources of software evaluation were valuable

Hands-on time on computers.

I found the first class to be excellent in its presentation of the overview, history, etc., of computers.

The hands-on experience was great and probably the best teacher.

Access to software companies.

Reference material was good. Verbal presentation was good.

The highly qualified instructor. The most advanced and updated equipment.

Being able to inter-change ideas with each other on software.

The variety of information. The hands-on.

Helpful, non-threatening to a true beginner, indstructor was very helpful and always willing to provide assistance.

I found the resource material informative.

The access to the software and kinds of equipment.

The variety of hardware and software was both informative and ianteresting.

Time on the computers. Using the various programs.

The teacher's enthusiasm, patience and information.

Working on the computers.

Informative handout materials. Good hands-on experience on various vendor products.

Handouts of resource materials and knowledge of instructors.

Access to wide variety of materials and hands-on.

Handouts and the hands-on activities.

Working with various types of software and hardware. Getting an update on research and available literature.

Hands-on experience.

Informal atmosphere. The quality of the instructor to address the students needs.

The informal way that these workshops sessions were presented. I also liked the hands-on experiences as well as the presentations by the instructors.

Small groups led to much hands-on activities. This workshop will help me in the future as a teacher.

Very pleased that we didn't waste anytime getting to the "hands-on" experience. Everything was already set up and we were on our own with help available when needed. Loved it.

Suggestions made continued.

Greater instructor-student ratio during the hands-on portion of the class. Possibly computer students to help.

More hands-on time.

Have better initial instructions for starting computers. Have better instructions for correcting errors and using the keyboards.

A better instructor to student tation would help when trying to work through the problems with the fundamental during the hands-on workshop.

More available software on related areas of interest.

Select a few popular and easy to understand programs and assign them in three weeks each student will be able to go thru at least 6. You could possibly have the 3rd session set aside for personal picks, and also allow more advanced students to choose their own.

Spend more time with programming and what types of programming would be good for specific areas.

Possibly some more time spent on the actual concepts involved to software creation.

Allow for more than just 3 sessions.

Comparison of programming languages and samples and their different applications.

Martinis, rest time as is.

Discuss how to integrate programs into curriculum.

State objectives (specific) and same way of measuring whether or not one has met those objectives.

I would like to attend any future workshops.

More hands-on.

GLOSSARY

This glossary of terms deals specifically with microcomputer software. For a more complete glossary dealing with microcomputers, the reader should consult the companion booklet "A Guide to Microcomputers."

BASIC

An acronym for beginners all purpose symbolic instruction code. A high level conversational, interpretative programming language in wide use. Always written in capital letters, BASIC was invented by Kemmeny and Curtz at Darmouth College in 1963. It permits the use of simple English words and common mathematical symbols to perform the necessary arithematic and logical operations needed in programming microcomputers.

BRANCHING PROGRAMS

An instructional program designed in such a way that the student's progress through the program is determined by the specific answers given. If remedial work is required, the microcomputer will take the students into a remedial branch and provide the work necessary before continuing through the main portion of the program. The path a student uses is determined by that student's response.

CASSETTE (CASSETTE RECORDER)

A device for preserving internally stored information. Because most computers lose the information stored in them when they are turned off, a means of permanent storage of the information is necessary. This method of storage is faster than disks or solid state cassettes. Cassettes are the same as audio recording cassettes.

CLASSROOM MANAGEMENT SYSTEMS

A program that maintains the class records for a teacher. It may include grades, test scores, attendance, as well as other student information.

COMPATIBILITY

There are two types of compatibility: program and hardware. The program compatibility refers to the ability to run programs on a variety of computers without changing the program language. Hardware compatibility means the various components (printers, disks, keyboards, etc.) may be connected directly without intervening electronic devices and that all components use the same baud rate, word length, and other technical aspects in order to communicate. Compatibility also should be considered between the computer program and the normal instructional program used in the school.

COMPUTER ASSISTED INSTRUCTION

Direct instruction conducted by the computer. Examples of this type of instruction are: drill and practice, tutorial, simulation and gaming, inquiry and dialogue, information retrieval, and problem solving.

COMPUTER LANGUAGE

A language used to communicate with a computer. All computer language instructions must be translated by a program within the computer into the machine's internal language in order for the instructions to be implemented.

COMPUTER LITERACY

An understanding of computers and their application in the everyday world. To be computer literate, a person should have a cursory understanding of: computer programming, problem solving, applications of computers in various fields, the impact of computers on society, computer system components and computer capabilities and limitations.

COMPUTER MANAGED INSTRUCTION

Instructional support functions conducted by the computer. Examples of the support functions are: testing, prescribing, record keeping, schedule monitoring, and time and resource management.

COURSEWARE

Computer programs (software) designed for instructional purposes. See also software.

CRT

An acronym for Cathode Ray Rube. Similar in appearance to a television screen. Most microcomputers use a CRT as their output device. See also monitor and video display unit.

DISK (DISC)

A record-like magnetic-coded piece of material that can store programs, data or tables of information. The process is similar to storing music information on a magnetic tape. Commonly found as floppy and hard disk systems.

DISK DRIVE

A mechanical unit that may be built into the microcomputer case or may be an add-on peripheral which reads and records on a round magnetic surface. See also "Disk" and "floppy disk."

GRAPHICS

Characters that can be used to form figures, shapes, and forms on the CRT or printer. In addition to letters and numbers, a computer may have a graphics character set that can be used to create graphics by writing them into a traditional computer program, by using a graphics tablet, or by using a light pen on the CRT surface; depending upon the capability

GRAPHICS TABLET

A flat device, when drawn upon, which will transmit the drawing to the output device, microcomputer's memory and/or its storage device.

HARDWARE

Mechanical, magnetic, electrical and electronic devices which make up a computer. The physical equipment that goes into a computer system consisting of the central processing unit plus all the peripherals.

HIGH RESOLUTION

A video monitor or the microcomputer's capability of producing and reading at least 256 lines or columns of dot pattern. High resolution graphics produce an image that has the detail approximating a photograph.

JOY STICKS

Small control devices which allows the computer operator to control actions or graphics on the CRT. Most commonly associated with their use in computer games.

LANGUAGE

A format by which a programmer can communicate effectively with a computer where predetermined commands will produce requested actions. BASIC is one of the most popular languages used with microcomputers.

LINEAR PROGRAM

A program written in such a way that all students must proceed through each step or question of the program.

LOW RESOLUTION

Video monitors or microcomputer capabilities that produce graphics as a series of square blocks. Usually, there are 64 blocks in each row.

MEMORY

The integrated circuits of a computer which store information. In microcomputers, they are referred to as RAM and ROM.

MONITOR

A video display unit which uses a CRT tube to generate characters. It looks much like a normal television set and may be either black and white or color, as well as high or low resolution.

PERIPHERAL DEVICE

A device, such as a printer, mass storage unit, or keyboard, which is an accessory to a microprocessor and which transfers information to and from the microprocessor.

PROGRAM

A series of instructions to a computer which cause the computer to solve a problem or perform a task.

PROGRAMMED INSTRUCTION

A technique of organizing instruction into a series of very small segments which by their design leads the learner through the program with a minimum of incorrect responses.

RAM

An acronym for random access memory. Any memory which can be written on or read from by a program and in which the memory locations can be accessed in a random sequence. RAM can be erased and reprogrammed by the programmer as frequently as necessary. RAM size is expressed as a quantity of bytes, such as 4K (4,000 bytes). RAM may be expanded by adding memory chips or memory boards.

ROM

An acronym for read only memory. It is made of an integrated circuit on which data or instructions are programmed at the time of manufacture. It cannot be erased or reprogrammed by normal computer operations. The size of ROM is expressed as the quantity of bytes, for example, 12K (12,000 bytes).

SOFTWARE

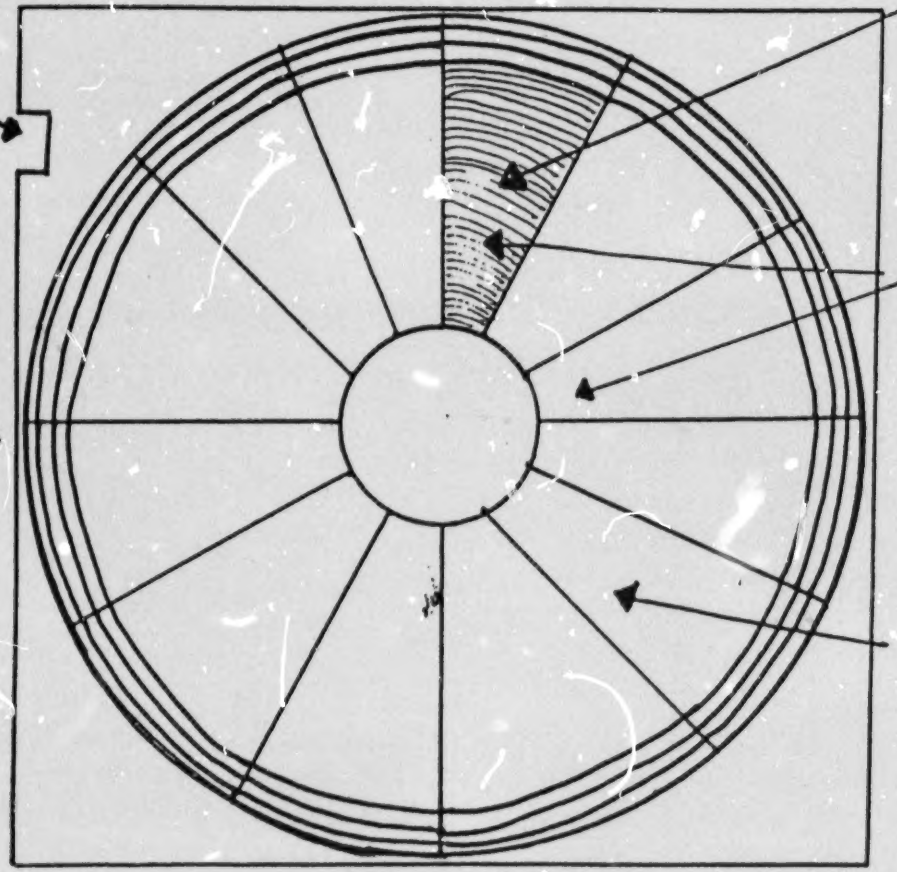
The programs and accompanying documentation. Software is stored on tape cassettes, disks, and solid state cartridges. These are permanent method of storage and are not erased when the computer is turned off. The computer reads the software into its temporary memory (RAM) in order to manipulate the data in its functioning. See also courseware.

VIDEO DISPLAY UNIT

A component of a microcomputer system which displays the output on a screen similar to a TV screen. See also Monitor and CRT.

"THE DISK"
(alias the Floppy disk, the diskette, soft disk)

The square cutout on the right side of the disk is the "write enable notch." When the notch is open, new information can be written. When notch is covered, information can be read but not written on disk.



The DISK has 35 circular tracks. Each track is divided into 16 sectors.

The resulting 560 sectors are shaped like sections of a dartboard. Information is stored in each sector.

The outer 3 tracks are the DOS(Disk Operating System)

"BOOTING" means loading the DOS program into the computer.

Each sector can hold 256 characters. The total capacity of a disk is 143,360 characters, or roughly 40 single-spaced typewriter pages.

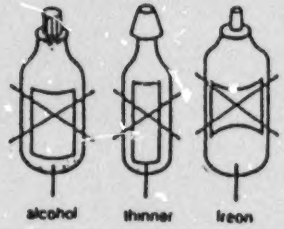
KEYBOARD has 52 keys, but 91 different codes can be generated by keyboard combinations.

Disks give approximately 40 hours of use.

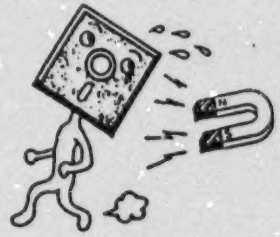
Floppy Disk Handling

1. Do not touch disk surface. It is easily contaminated which causes errors.

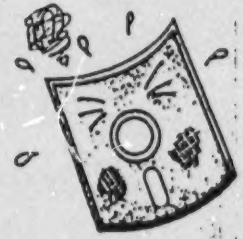
2. Do not use alcohol, thinners, or freon to clean disk.



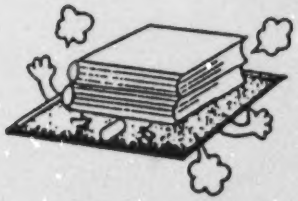
3. Do not use magnets or magnetized objects near the disk. Data can be lost from a disk exposed to a magnetic field.



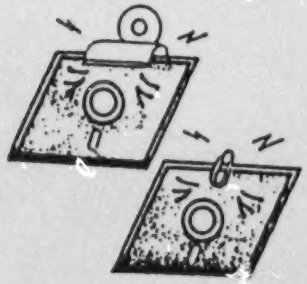
4. Do not bend or fold the disk.



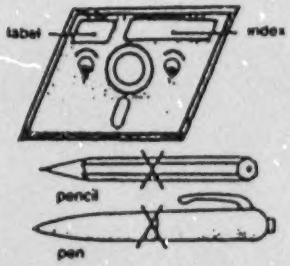
5. Do not place heavy objects on the disk.



6. Do not use rubber bands or paper clips on the disk.



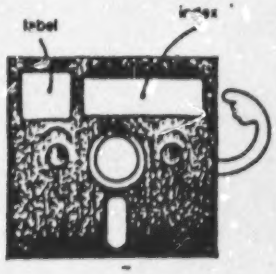
7. Do not write on disk with pencil or pen. Use only a felt tip marker.



8. Do not use an eraser on label or disk.

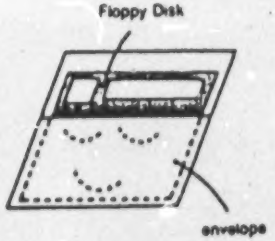
Floppy Disk Storage

9. Apply index label to the right of the company label. Do not use labels in layers.

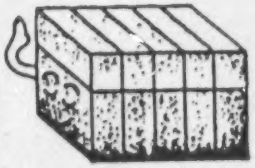


10. Insert carefully by grasping upper edge and placing it into the drive.

11. Keep disk in a protective envelope when not in use.

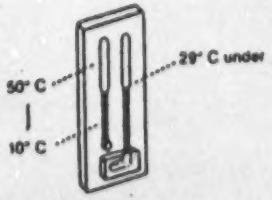


12. Disks not being used should be stored vertically in box.

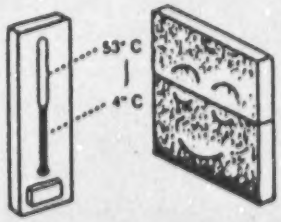


13. Do not expose the disk to excessive heat or sunlight.

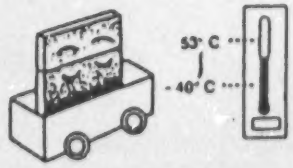
14. Operating environment.
    a. Temperature 10C to 50C.
    b. Relative humidity 20 to 80.
    c. Wet bulb temperature less than 29 C.



15. Storage Environment
    a. Temperature 4C to 53C.
    b. Relative humidity 8 to 80.



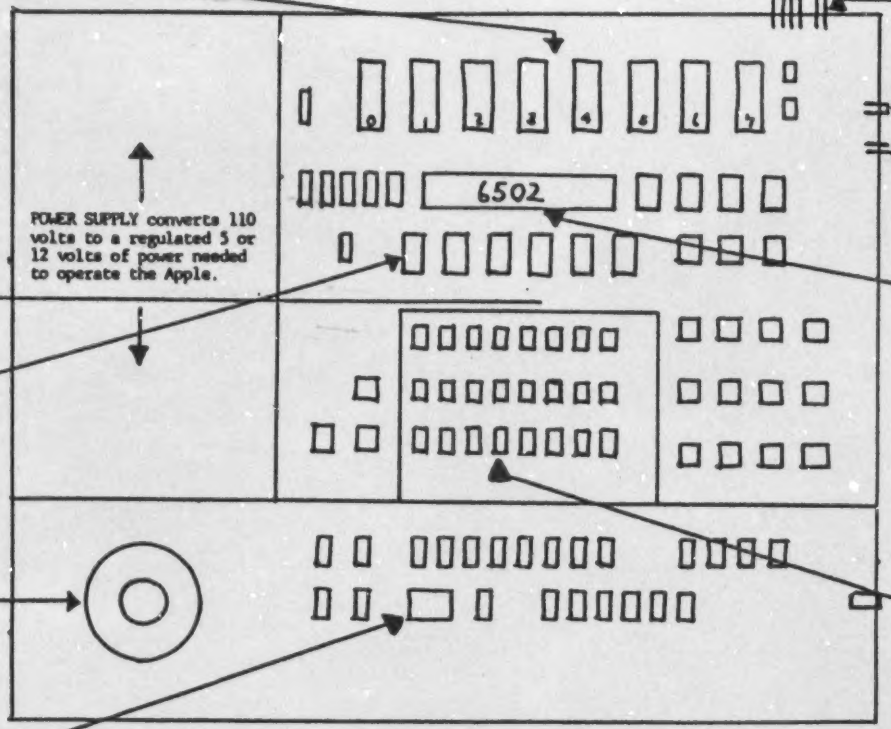
16. While in transit disk should be in its envelope and in protective box within the following ranges. Temp 40 C to 53 C.



INTERFACE SLOTS #0 to #7

Each slot hold one interface card. These cards expand the Apple's capability. An interface card can link the computer to a printer, disk drive, modem, etc. Standard slot for disk drive is #6 and the printer card usually plugs into slot #1. Slot #0 is reserved for a card enabling you to use languages other than Applesoft BASIC.

THE APPLE'S "CORE"



Cassette IN/OUT jack. Sends and receives information from a cassette tape recorder.

Video Out connects to monitor.

Auxiliary video output pins. They connect to a RF modulator so the Apple's video signal can be used by a TV.

Paddles or Joysticks

CPU (Central Processing Unit)

POWER SUPPLY converts 110 volts to a regulated 5 or 12 volts of power needed to operate the Apple.

ROM is permanent memory. Cannot be changed, altered, or erased.

The ROM chip, the AUTOSORT is activated when the Apple is turned on. It contains a permanent program that accesses the disk drive.

SPEAKER can produce sounds - music, computer noises like beeps, honks, explosions, etc. Can also simulate voices.

A lower case adapter can be installed here to give your Apple the ability to display lower case letters on screen.

RAM contents are not permanent. They can be changed, altered, or erased. RAM is cleared when the Apple's power is turned off. Stores data and instructions that are entered from the keyboard, disk drive, or other devices. Can be a word processor, video game, or a calculator, depending on what is loaded into RAM.

The entire inside board is called the "MOTHERBOARD."

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HANDS ON

ROOM 16

Station 1 - LOGO on the T.I. 99/4A
The turtle responds to commands such as:
Forward (FD) requires a number (eg FD 10)
Left (LT) requires degrees (eg LT 60)
Right (RT) requires degrees
Back (BK) requires a number
Try these four commands to make a turtle drawing.

Type: TELL TURTLE <ENTER>
FD 50 Remeber to press ENTER
RT 90 after each line
FD 50
RT 90 Uses CS to clear the screen
FD 50 and either begin again or
RT 90 type in a new program.
FD 50
Now shorten the program.

Type: CS <ENTER>
REPEAT 4 FD 50 RT 90 ENTER
What happens?
Try your own variations

Next follow the directions beside the computer to load programs from the caseette.

Station 2 - Bank Street Writer
Try the tutorial program first unless you are acquainted with the program. Hold the disk by the label. Turn the disk updide down and insert it into the disk drive for the tutorial program.

Station 3 - Try one of the MECC programs, either the Science or Math disks.
Note the supplemental materials

Try the Lemonade simulation. Insert the disk if the computer is on type PR #6 and press <RETURN>. Type LOAD LEMONADE (press RETURN). When the red light on the disk drive goes out, Type RUN and follow directions.

ROOM 14

For the TRS-80 MODEL III

1. To use a cassette, hit the EJECT button on the cassette recorder and insert the cassette. Close the cassette recorder cover. Turn on the microcomputer (Switch is on the right underside of the keyboard). When you see CASS? displayed on the monitor, type L. For Memory Size?; hit ENTER. When you see the cursor, type CLOAD and press the play button on the cassette recorder. You should see two* (asterisks) in the upper right corner of the monitor. The one will blink. When it stops blinking, your program is loaded. When the computer displays READY and a cursor appears, type RUN, hit enter and follow the directions.

2. To use a disk, turn on the computer (bottom right). When the red disk light goes off, insert the disk in the bottom disk drive and close the cover. Press the red reset button (right side of keyboard. Type in a date (11/11/11 will do). Press ENTER for TIME and the message will appear on the screen telling you how to proceed.

Station 4 - The Test Writer - enter two questions on any topic, print them and your answers. Follow the instructions in the manual.

Station 5 - The Micro-editor
Follow the highlighted directions. When the computer asks for the name of the lesson you're working on, type LESSON 2.
Use the instructions in the manual if you wish to go beyond LESSON 2

Station 6 - PLOT/GUESS THE RULE
This program is on a cassette. Follow the directions above to load the program. Then use the manual to graph a circle.

Station 7 - Try the Basic Keyboarding Skills Disks.
A brief description of the program is given on the yellow User's Guide.

Options:

1. The Gradekeeper
2. Microcomputer Oriented Accounting: A CAI Approach
3. Inventory Control System
4. Type in programs from Exercise sheets or programming books. Try to predict what will happen when you type RUN.

SELECTED BIBLIOGRAPHY

Consumer Reports

September, 1983	28 pages on home computers
October, 1983	Printers, Monitors, Word Processor
November, 1983	Educational programs for computers
February, 1984	Home computers for word processing

Back issues available @ $2.50
Back Issue Dept.
Consumers Union
P.O. Box 1949
Marion, OH 43305

Executive Computing: the RIA guide to personal computers.
New York: The Research Institute of America, 1983.

Harper, D.O. & Stewart, J.H.
Run: Computer education.
Monterey, CA: Brooks/Cole Publishing Co., 1983.

Heck, W., Johnson, J. & Kansky,R.
Guidelines for evaluating computerized instructional materials.
Reston, VA: National Council of Teachers of Mathematics, 1981.

Information technology and its impact on American education.
Washington, D.C.: U.S. Government Printing Office, 1982.

Pitts, M. The educator's unauthorized microcomputer survival manual.
Washington, D.C.: Council for Educational Development and Research, 1983.

Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped, 1981.
Order from: IEEE Service Center
445 Hoes Lane
Piscataway, NJ 08854

Smith, B. Computers. Tulsa, OK: Hayes Books, 1981.

Tindall, L.W. & Gugerty, J.J. Effective microcomputer assisted instruction for the vocational education of special needs students. Vocational Studies Center, School of Education, University of Wisconsin - Madison, 1983.
Listing of microcomputer programs and articles on the educational uses of the microcomputer.
$25.00 The Vocational Studies Center
University of Wisconsin - Madison
Publications Unit
964 Educational Sciences Building
1025 W. Johnson Street
Madison, WI 53706

Watt, Dan. Educational computing. Popular Computing 1984, 3 (5), 75-78.
Discusses what computer literacy is and the controversy surrounding it.

Zahniser, G., Long, J. & Nasman, L.
An administrator's guide to microcomputer resources.
Columbus, OH: The National Center for Research in Vocational Education, 1983.

Zahniser, G., Long, J. & Nasman, L. Microcomputers in voc. ed: a decision guide. Columbus, OH: The National Center for Research in Vocational Education, 1983.

CATALOGS OF COMPUTER SOFTWARE AND BOOKS

1. Activity Resources Company, Inc.
   P.O. Box 4875
   Hayward, CA 94540

2. Abraxas
   P.O. Box 1416
   Eugene, OR 97440

3. Creative Publications
   3977 East Bayshore Road
   P.O. Box 10328
   Palo Alto, CA 94303

4. Cuisenaire Co. of America, Inc.
   12 Church Street, Box D
   New Rochelle, NY 10805

5. Dale Seymour Publications
   P.O. Box 10888
   Palo Alto, CA 94303

6. Enrich/Ohaus
   2325 Paragon Drive
   San Jose, CA 95131
   (publishes Free Software For Your TI-44/4A Atars, Apple, Commodore.)

7. Educational Teaching Aids
   159 West Kinzie Street
   Chicago, IL 60610

8. MECC Distribution Center (Minnesota Educational Computing Consortium)
   3490 Lexington Avenue, North
   St. Paul, MN 55112

9. Opportunities for Learning, Inc.
   8950 Lurline Avenue, Dept. 6
   Chatsworth, CA 91311

10. Prentice-Hall Media
    150 White Plains Road
    Tarrytown, NY 10591

11. Queue Educational Software
    5 Chapel Hill Drive
    Fairfield, CT 06432

12. Scholastic Microcomputer Instructional Materials
    Scholastic Inc.
    P.O. Box 7501
    2931 E. McCarty Street
    Jefferson City, MO 65102

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13. South-Western Publishing Co.
    5101 Madison Road
    Cincinnati, OH 45227

14. Vocational Instructional Services
    F.E. Box 182
    Texas A & M University
    College Station, TX 77843-2588

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Software Evaluation Checklist

Filing Code _____

Subject Area _____ Grade Level(s) _____ Date __/__/__

Reviewer's Name _____

Program Name _____

System Requirements ____/____ Computer/RAM

Supplier _____ Price $ ____ Estimated Student Time ____ minutes

Instructions-Please mark the following items in each blank according to the extent the product fulfills the description in the item using the following system:

3=Excellent 2=Average 1=Poor 0=Not at All NA=not applicable

I. DOCUMENTATION:

___ Goals & Objectives
___ Operating Instructions
___ Correlation with textbooks
___ Activities for Introduction
___ Entry level skills (Prerequisites)
___ Sample runs of program (Tutorial)
___ Follow-up suggestions

II. INSTRUCTIONS GIVEN TO STUDENT:

___ Clarity of directions
___ Option of skipping instructions
___ Simplicity of student input
___ User control over display pacing
___ Screen formatting for ease of reading

III. PROGRAM'S INSTRUCTIONAL FEATURES:

___ Provides for individual needs (Varies levels of difficulty)
___ Text is appropriate to most students' reading level
___ Utilizes standard methods of responding to questions (right to left for input of sums in mathematics)
___ Immediate feedback with appropriate responses
___ Freedom from need for teacher assistance to operate program

IV. MOTIVATIONAL DEVICES:

___ Correct response feedback is more desirable than incorrect
___ Appropriate use of graphics and color
___ Provides a variety of responses for inputs
___ Provides for 'HELP' if difficulty is encountered
___ Provisions for turning off sound

V. CONTENT:

___ Matches your curricular goals
___ Is educationally significant
___ Is the content accurate ?

VI. SUMMARY:

___ Overall Evaluation
___ Potential for wide spread use in your district
___ Reactions of students
___ Reactions of other teachers

Comments:

_____

_____

_____

(Permission granted to copy this Checklist-Please note source Kansas State Univ/Whiteside)

SCHOOL MICROWARE EVALUATION FORM (COPY AS NEEDED)

Your Name_____ Organization_____ Position_____

Address_____ Tel:_____

Product Name_____ Supplier_____ Price $_____ No. of Progs. Under This Name_____

Subjects and Grades to Which Applicable_____ Est. Student Time Required_____

FUNCTIONAL DESCRIPTION - Describe the program in terms of its goals and what it does to achieve them. Give as much detail as possible (use extra sheets as necessary).

_____

_____

_____

_____

PRELIMINARY CONSIDERATION - Does this program contribute to the teaching of topic(s) which should be taught in today's schools? ___Yes ___No If No, give your reasons for this answer in the Comments section at the end of the form and omit the balance of the questionnaire.

INSTRUCTIONS - Enter a number in the blank to indicate the extent to which the product fulfills the description in the item, as follows: 2 - Completely, 1 - Partially, 0 - Not at All. If the item is not applicable to the product, enter N/A. If the item is unclear, enter U. Elaborate on answers as necessary in Comments at end or on extra sheets, giving item numbers.

DOCUMENTATION - List materials accompanying the program, e.g., teachers guide, student workbook.

1. Indicate types of information included.
   - _____ a. Suggested course/subject, grade levels.
   - _____ b. Goals.
   - _____ c. Performance objectives.
   - _____ d. Suggested teaching strategies).
   - _____ e. Correlation with standard texts.
   - _____ f. Prerequisites for use of program.
   - _____ g. Student exercises, teacher answers.
   - _____ h. Operating instructions.
   - _____ i. Listing and sample runs of program(s).
   - _____ j. If a simulation, description of the model used.
   - _____ k. Suggested topics for follow-up discussions.
   - _____ l. Suggested references/activities for follow-up.
2. _____ The documentation is written clearly.
3. _____ If a workbook is included, the format and content are appropriate.

INSTRUCTIONS GIVEN TO USER BY PROGRAM

1. The instructions are adequate regarding:
   - _____ a. The instructional task to be performed.
   - _____ b. Details of how to interact with the program.
2. _____ User has the option of skipping instructions if already known.

STUDENT-COMPUTER DIALOG

1. _____ Output is displayed screen by screen (paged) rather than scrolled.
2. If output is paged:
   - _____ a. User has control over continuing to the next page.
   - _____ b. Amount of information in each page is appropriate.
   - _____ c. The perceptual impact (amount of type and lines) is suitable.
3. _____ Output is spaced and formatted so as to be easily readable.
4. _____ Language is well suited to most students' reading ability.
5. _____ Uses correct grammar, spelling, hyphenation and punctuation.
6. _____ Any grid or coordinate system used is consistent with common conventions.
7. _____ Students can respond with common symbols & ways of using them, e.g., right to left entry of sums.
8. _____ Accepts abbreviations for common responses.
9. _____ Provides for individual needs, e.g., opportunity to work with harder or easier material.
10. _____ Dialog is personalized, i.e., makes appropriate use of student names.
11. _____ Uses devices to get & maintain interest, e.g., variation of computer responses, humor, pace change, surprise.
12. Makes good use of any special features computer:
    a. Graphics _____ b. Color _____ c. Sound _____
13. _____ Reinforcing responses (indications of right, wrong, etc.) are appropriate.
14. _____ The number of wrong answers allowed is reasonable.
15. _____ Responds appropriately if allowed number of wrong answers is exceeded.
16. _____ Provides opportunity to get help if difficulty is encountered.
17. _____ Minimizes bad entries via devices such as objective formats (multiple choice, etc).
18. _____ Deals well with inappropriate entries, i.e., response to typing errors, etc., is intelligible and useful.
19. _____ Required entries are within students' capabilities (esp. typing, vocabulary).
20. _____ Reports student performance periodically and at end of session.

MISCELLANEOUS CONCERNS

1. _____ If a simulation, the program gives a sufficiently accurate representation of the situation simulated.
2. _____ The concepts and vocabulary required to use the program are reasonable.
3. _____ Operates properly and is free of bugs.
4. _____ Is well structured and documented internally to facilitate any necessary debugging/modification.

COMMENTS - Please use this space and additional sheets as necessary to provide any information which you believe would help someone who is thinking about buying of the product being reviewed. In particular, indicate what you like best and least about the program. Also, list any changes which should be made.

_____

_____

_____

Revised 8/82

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INSTRUCTIONAL SOFTWARE REVIEW QUESTIONS

Rationale, Goals, Objectives

1. Is the program's rationale set forth clearly?
2. Does the rationale make sense?
3. Are the program's goals clearly stated?
4. Are the goals consistent with the program's rationale?
5. Are the goals appropriate for the students who will use the program?
6. Are there explicitly stated objectives corresponding to all the goals?
7. Do the objectives clearly communicate the developers' intent to the teacher?
8. Is the program compatible with your instructional objective(s)?
9. Will the program help you achieve your instructional objective(s)?

Content

1. Is the program's content accurate?
2. Is the content complete, and logically organized?
3. Is the range of skills included in the program sufficient to meet the program's objectives?
4. Do the skills match the needs and abilities of students who will use the program?

Instruction

1. Does the program use a sufficient variety of instructional strategies?
2. Are the program's objectives shared with students?
3. Are there ample opportunities to practice skills stated in the objectives?
4. Is the sequencing of instruction clear?
5. Are the materials free from sexual, social, or racial bias?
6. Does the program provide students with adequate feedback?
7. Is the form of the feedback and the response to student errors appropriate?
8. Does the program provide an adequate record of student performance?

The Student

1. Does the program's reading level match student ability level?
2. Is the program self-instructional or will it require teacher intervention?
3. Are instructions to students clear and easily understood?
4. Does the program offer students the option of stopping or exiting?
5. Can students control the duration of the display on the screen?
6. Is the typeface used in the program easy to read?
7. Are student interest and active involvement likely to be maintained?

The Teacher

1. How easily can teachers use the program and how easily can they incorporate the program into their instruction?
2. Does the program include materials for the teacher?

3. Are the teacher materials clearly organized?
4. Do the teacher materials explain the program's objectives?
5. Is the information contained in the teacher materials correct?
6. Are the teachers who will use the program familiar with the subject matter content?
7. Are the teachers reasonable convinced that their students can perform well in the program and that they will like it?
8. Do the teachers think the program's teacher materials give them sufficient orientation to operate the program in their classrooms?

Assessment

1. Do tests or assessments in the program adequately measure what the program teaches?
2. Is there a good match between the program's goals and assessment procedures?
3. Do the assessment procedures sample a reasonable portion of learning outcomes?
4. Are the most emphasized learning outcomes adequately assessed?
5. Are the items included in the tests carefully and correctly constructed?
6. Are a sufficient variety of procedures used to assess student performance?

Evaluation

1. Did the program go through a development cycle which included field testing?
2. Is a program evaluation report or report of field testing available?
3. Does the program provide evidence that:
   a. Students learn by engaging in the program's activities?
   b. Students learn what the program developers intend for them to learn?
   c. Students enjoy working with the program?
4. Who are the program's developers?
5. Do they have sufficient knowledge of instructional methods, the academic disciplines relevant to the program's content, and the characteristics of the learners who will use the program?

Cost

1. What is the program's purchase price?
2. What is the cost of consumable supplies/materials needed for the program?
3. What is the annual per pupil cost of the program?
4. What is the cost of any training necessary to prepare teachers to use the program?

Criteria for Judging Microcomputer Hardware

1. Cost: What is the total cost of the microcomputer? This includes price of any extra equipment you may purchase for the device (e.g., a printer), installation, and costs of cartage as well as the basic purchase price.

2. Flexibility: If necessary, can the unit be readily moved? Has it been tested for durability? How much does it weigh? Must the unit be near an outlet or telephone lines to operate? Do students have to be brought to the unit or can the unit be taken to students? Is there a need for special environmental controls (i.e., temperature, humidity, dust, protection from exterior electrical interference including other computers, static charges, another electromagnetic field)? Is a special electrical hook-up required?

3. Mainframe Interface: Does the unit have the ability to interface or connect with available mainframe computers? Do you require such capability?

4. Keyboard Layout: Most micros come with a standard typewriter layout. If the unit does not, will it fit your needs? Does it have a calculator layout? Is a calculator layout necessary or can the standard typewriter numbers fulfill your calculation needs?

5. Additional Ports: Can other devices be connected to the unit (e.g., printers, plotters, phone lines)? Are there sufficient ports to support the number of extra devices you need?

6. Execution Time and Loading Speed: How long does it take the microcomputer to execute an operation? How fast can information be loaded into the unit? Is the execution time, operation or loading of a program too long for students?

7. Memory Capability: How much ROM memory is the unit capable of? How much RAM memory can be taped?

8. System Expansion: Can the system be expanded easily? What are the limits of the expansion?

9. Editing: Can you edit as mistakes occur? Is editing simple? After the program is completed can you edit? Can you make changes in the program to suit your needs? Will the unit identify specific program errors?

10. Input and Output Devices: What input and output devices (e.g., cassette, disk, TV monitor, printer, plotter, graphics tablet, light pen, voice synthesizer) are included with the equipment?

11. Software: Are there sufficient manuals, reference and program materials available to support the microcomputer? Are programs suited to your needs available? Have outside companies other than the original designer, made additional software programs? Is there enough software available to fulfill your needs? Can programs be modified to fulfill your needs? Have the programs been validated (field tested with students)? What is the cost of prepared programs?

12. Graphics/Characters: Is the unit capable of low or high resolution graphics? How many characters per line are available on the micro? How many lines on the display screen are visible? What is the screen size?

13. Color: Is color necessary for your operations? If so, will it require a special kind of monitor?

14. Extra Equipment: What kind of extra equipment is available (e.g., printer, voice synthesizer)? Do you need these extra devices?

15. Servicing: What warranties are available? Can the unit be serviced where you purchased it? Is on-site servicing available? Can local technicians make necessary repairs? For additional cost, will the unit be updated for the next year to reflect refinements? How long does it take for service including transportation to and from the service facility? What is the service charge including transportation?

16. User Training: Will the vendor provide on-site user training? At what cost? How many hours? For how many people?

Rating Hardward Systems

Directions: This sheet provides a common format to compare several microcomputers. To complete the form's four sections - comments, rank, importance, rating - follow the directions below.

Comments: Write notes about a particular microcomputer in this column.

Rank: Use a scale ranging from 1-5 to translate your comments about the system into a rank value. For example, if the cost is high, give it a 1. If the unit is easily moved, assign flexibility a rank of 5. If servicing is not available, give this category a 0.

Importance Factors: Numbers in this column reflect your needs and the applications you have in mind. Assign a number of 1-10 each category. If your most important concern, for example, is the system's graphics capabilities, assign this category a 10. These weights reflect your needs and priorities. They should be applied to each system you're evaluating.

Rating: Multiply the rank value for each category (column C) by the importance factor (column D). For example if cost is of major importance (i.e. importance=10) and the system's price is well within your budget (i.e. rank =5), you would enter a 50 in the rating column next to cost.

Total Rating: For each microcomputer you investigate, add up the total number of points in the rating column. The higher the total points, the more a system conforms to your needs. But, compare the capabilities of two or three systems with similar ratings to note any categories you're willing to trade off for others.

Microcomputer Hardware Rating Sheet

Brand: _____ Model: _____

A. CRITERIA	B. COMMENTS	C. RANK (1-5)	D. IMPORTANCE (1-10)	RATING
1. Cost				
2. Flexibility				
3. Mainframe Interface				
4. Keyboard				
5. Additional Ports				
6. Execution Time & Loading Speed				
7. Memory Capacity				
8. System Expansion				
9. Editing				
10. Input & Output Devices				
11. Software				
12. Graphics & Characters				
13. Color				
14. Extra Equipment				
15. Servicing				
16. User Training				

TOTAL

'TRY THESE EXERCISES ON THE TRS 80 MICROCOMPUTERS.

Computers are capable of handling large amounts of information rapidly. To discover how the computer handles numerical and character information, type the following input data, predict the output, press ENTER to check your prediction.

	INPUT	PREDICTION
1.)	PRINT 3 PRINT 3.0 PRINT 3.570 PRINT +6.73 PRINT -3.54 ? 6.700	
2.)	PRINT 100000 PRINT 1000000 PRINT 0.06 PRINT 0.005	
3.)	PRINT "A" PRINT PRINT "SHE SAID "HAVE A GOOD DAY" PRINT "SHE SAID 'HAVE A GOOD DAY'" PRINT "HI THERE, I'M YOUR FRIENDLY COMPUTER."	
4.)	PRINT 3+4 ? "3+4" PRINT "3+4=" 3+4	
5.)	PRINT 6*5 PRINT 10/5 Print 2↑3	

COMMENTS:

1.) Trailing zeros after the decimal point are dropped, the - sign is printed but not the + sign. The ? is an abbrevation for PRINT.

2.) At 1 million, scientific notation is used. E represents exponents or powers of 10.

3.) Character information (letters or numerals) is always enclosed in quotation marks and may contain up to 255 characters. The word PRINT by itself causes the computer to skip a line. A quotation may contain only the beginning quotation marks. Always use apostrophes within quotes. If the closing quotation marks are missing, the computer doesn't mind.

4.) In the first example where no quotation marks are used, the computer performs the operation and displays the sum. In the second, the computer prints whatever is between the quotation marks. The third example is a combination of the first and second.

5.) The arterisk is the symbol for multiplication, the slash for division. The for exponents.

Programming the computer

A. Turn on the computer.

B. Try the following programs. After typing each line press ENTER. When you have typed the entire program, type RUN to see the computer's response. When you see this symbol , press the space bar.

```
10  PRINT   "RED"
20  PRINT   "            BLUE"
30  PRINT          "GREEN"
40  PRINT    "5+6"
50  PRINT    5+6
60  PRINT
70  PRINT    "YOUR NAME"
80  END
```

C. Type NEW when beginning a new program.

```
10  PRINT "YOUR NAME"
20  GOTO 10
30  END
```

D. Try some graphics using trigonometric functions. Remeber to type NEW to begin a new program, press ENTER after each line and type RUN to see what happens.

```
10  FOR A = 0 TO 6.3 STEP .2
20  LET Y = SIN(A)
30  PRINT TAB (20*Y+20); "YOUR NAME"
40  NEXT A
50  END
```

```
10  FOR A=0 TO 6.3 STEP .2
20  LET Y=COS(A)
30  PRINT TAB (20*Y+20);  "YOUR NAME"
40  NEXT A
50  END
```

```
10  FOR A=0 TO 9.5 STEP .2
20  LET Y=COS (2*A)  +SIN(A)
30  PRINT TAB (15*Y=30);  "YOUR NAME"
40  NEXT A
50  END
```

APPENDIX H

COMPUTER LITERACY FOR VOCATIONAL TEACHERS OF THE HANDICAPPED

Funding Provided By:
Pennsylvania Department of Education
Bureau of Vocational Education

Prepared By:
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University of Pittsburgh
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I. INTRODUCTION

At a recent Pennsylvania Educational Research Association meeting in Pittsburgh, Gregory Jackson, Co-Director of Harvard University's Educational Technology Center, outlined four phases in the use of technology. They are 1) curiosity, 2) acquisition, 3) reappraisal, and 4) real progress. Jackson believes that we are very good at training people to use computers in the workplace, and we are at the reappraisal phase with computer literacy efforts. However, we are only at the acquisition stage in using computers to teach, and much more research needs to be done on how computers can most effectively and efficiently be used in the classroom.

The reader will find in this booklet a synthesis of the most up-to-date information from a variety of sources. It contains useful descriptions for teachers and administrators of how computers are presently being used with handicapped students. References will be helpful to those desiring further information about this timely topic.

II. WHAT IS COMPUTER LITERACY?

Computer literacy is a hot topic today in schools as well as in state legislatures. It ranks at the top of the educational priority list along with renewed emphasis on mathematics and science education. Dan Watt, in the March 1984 issue of *Popular Computing*, tells of participating on an advisory panel which defined computer literacy for the Educational Testing Service (E.T.S.) The broad definition agreed upon was that "computer literacy may be defined as whatever a person needs to know and do with computers in order to function competently in our information-based society" (Watt, 1984, p. 75). The E.T.S. *Developments* publication contains a definition agreed upon by an advisory panel for a U.S. Department of Education project to assess computer literacy in schools. It includes the following:

(1) ability to use and instruct computers to aid in learning, solving problems, and managing information;
(2) knowledge of function, applications, capabilities, limitations, and social implications of computers and related technology; and
(3) understanding needed to learn and evaluate new applications and social issues as they arise *(E.T.S. Developments,* 1984, p.9).

Both definitions recognize that special skills are needed for technical fields and that skills, knowledge and understanding will vary with time, task and person.

Watt (1984) urges us to proceed with caution in our pursuit of computer literacy in schools. We need to achieve a balance between programming and applications which will vary with individuals. We also need to consider where computer literacy fits in the curriculum. He urges us to provide computer access to **all** students, not to just the gifted or to those who might need it for a career.

One of Watt's earlier definitions is extended by Anderson (1983) to include computer literacy for teachers and teacher educators. She realistically outlines problems such as cost for facilities and faculty resistance and suggests solutions. She also describes places where interesting programs are taking place.

Whether definitions of computer literacy include programming skills or not, all emphasize the need to use software and hardware to enhance learning. Software, once the stepchild of the computer industry, has grown to an estimated $16.5 billion in sales for 1984, according to *Time* magazine (April 16, 1984). Described as the "soul of the machine," software contains the programs which computers run. Educators are cautioned to first determine how the computer can be used to meet curricular objectives, then locate appropriate software and, lastly, purchase the hardware to run it. A computer without software can only be used for programming.

Software

A lot of software is being produced. *Time* for March 5, 1984, reports that at a software trade fair in New Orleans 12,000 software programs were displayed by more than 600 manufacturers. Not all of these programs are for education. To help educators select appropriate educational software, resources are available such as *Evaluation of Educational Software: a guide to guides, The Educator's Unauthorized Microcomputer Survival Manual,* and *Effective Microcomputer — Assisted Instruction for the Vocational Education of Special Needs Students.* These are described in the annotated bibliography at the end of this booklet. Other sources of information are State Intermediate Units within the Commonwealth of Pennsylvania. The Allegheny Intermediate Unit has a *Softworks* publication which contains software descriptions. Computer magazines like *Popular Computing, Educational Computer* and *BYTE* devote sections to software and courseware listings and reviews.

Hardware

Computer hardware is the mechanical equipment that makes up the computer system. It might be as simple as a central processing unit (CPU) combined with a keyboard as an input device attached to a video display unit. Peripherals are all the accessory parts not essential to the computer's operation. Because every computer has a limited memory (RAM or random access memory), programs can be stored on cassettes or disks.

Cassettes require recorders; disks require one or several disk drives. A printer is needed if hard copies of programs are to be saved. Joy sticks are other peripherals which control graphics or action in computer games. A graphics tablet is a flat device which will transmit drawings made on it with a special pen to the video display unit, printer or storage device. A speech synthesizer, a device which enables a microcomputer to "talk," is a great help to students experiencing language or reading difficulties. A modem links one computer with another over a telephone line. A color monitor rather than a black or green screen might be considered an accessory.

The task for educators is to define their needs so that they can purchase an adequate computer hardware system. The basic system should be capable of expansion if additional equipment or memory is deemed necessary at some future time.

III. HOW DID COMPUTERS EVOLVE?

Our ten fingers probably formed the basis of the decimal numeration system and children today still use them as calculators. Ancient civilizations invented a variety of calculating devices such as the abacus, and they are known to have used stone alignments and heavenly bodies as astronomical computers. John Napier, a Scottish mathematician, developed a set of rods known as Napier's Bones which are used for multiplication. Blaise Pascal, a French mathematician and philosopher, invented a computing machine which would perform addition and subtraction calculations.

However, the true forerunners of modern computers were Basile Bouchon's loom which wove patterns from programs punched on a continuous belt, Joseph Jacquard's loom controlled by punched cards, and Charles Babbage's "Analytic Engine," a number cruncher also using punched cards. Hollerith and Billings processed 1890 census data from punched cards. ENIAC (Electronic Numerical Integrator and Calculator) built in 1945 at the University of Pennsylvania was the first electronic digital computer. It weighed 30 tons, had to be manually rewired to perform different operations and used 18,000 vacuum tubes, one of which failed every seven minutes. Early computers were very large, consumed huge quantities of electricity and had to be housed in air conditioned rooms because of the heat they generated.

The microprocessor chip developed in 1974 became the "brain" of present-day microcomputers and sparked a miniaturization revolution. The first small home computer, the Altair, went on sale in 1975 followed by Apple, Radio Shack and Commodore personal computers in 1977.

According to the Research Institute of America in their publication *Executive Computing* (1983):

> A social scientist named Wilbur Schramm has calculated that it took mankind 5 million years to go from oral to written communications; 5,000 years to go from writing to printing; and only 500 years to go from printing to telephones and televisions. Now consider that television is only about 40 years old. Fifteen years ago no one had a pocket calculator, and just five years ago there were no ads for personal computers. In 1980, 35,000 personal computers were sold. In 1984, 3.5 million personal computers will be sold, according to the projections of the International Data Corp., and still the technical revolution continues (p. 9-10).

Interactive videodisc learning systems which combine the "emotional power of television with the interactive power of the computer" (Currier, 1983) will provide experiences which simulate reality far better than present microcomputer simulations. These are being used by industry today. Their initial cost has been a deterrent to use in schools. However, costs are rapidly decreasing and this technological innovation may soon be in reach of educators.

IV. HOW ARE MICROCOMPUTERS BEING USED?

A national survey of school uses of microcomputers was conducted by The Johns Hopkins University Center for Social Organization of Schools. Between December 1982 and February 1983, information was collected from 96% of a random national sample of 2,209 public, private and parochial schools in the United States. Data revealed that by January, 1983, 53% of U.S. schools had at least one microcomputer; secondary schools were more likely to have one than elementary schools; and least likely to have one were non-public elementary schools and public schools in poor districts.

The researchers also found that microcomputers in elementary schools tend to be used for computer literacy, drill and practice, and programming in that order and that in secondary schools they are used primarily for computer literacy, then programming, drill and practice. Regular users in about half the schools surveyed seemed to be only one or two teachers who encouraged the initial purchase of the microcomputers; they tend to teach programming to above-average students. Where groups of teachers and administrators played a role in acquiring the computers, the range of students using them was greater as was the time the equipment was in use each day. Secondary schools more often found money in their regular budgets to purchase microcomputers while elementary schools sought grant money or special funding sources such as P.T.A. groups (Becker, 1983).

V. HOW ARE COMPUTERS USED AS AN AID WITH STUDENTS?

The microcomputer is a tireless tutor with infinite patience. It is therefore an excellent tool for drill and practice. Many software programs are available which use random number generation to provide nonrepetitive drills in mathematics. Other software packages provide activities for reading and language skills. Many of these permit teachers to insert vocabulary words or spelling lists for individualization.

The computer performs calculations rapidly and so can figure earthquake waves or interplanetary distances with precision. This capability permits students to focus on processes such as how the epicenter of an earthquake is determined rather than becoming bogged down with calculations.

Many simulations are possible. Students can go west on a wagon train, perform potentially dangerous chemistry experiments, or experience objects falling in slow motion or in the absence of gravity. Such experiments or experiences promote discovery learning as do game situations. Strategies are developed and hypotheses formed which can be tested, revised if necessary, and retested. These activities promote the growth of logical thinking skills.

These uses of computers apply to normal as well as handicapped students. The advantage for the handicapped is that programs can be repeated as often as necessary and input devices can be modified.

A. Hearing, Speech and Language

This category includes the hearing impaired who have varying degrees of hearing ability, the deaf who usually are unable to understand speech without visual cues, and the aphasic who have lost aspects of language involving skills in reading, writing, listening or speaking. The *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped* lists 25 adaptations in this same category. These range from a vocalization trainer which enables hearing-impaired persons to match their vocalization with a model visual display on the screen, to a device which permits a caller to use a touch tone phone to communicate with a deaf person having a personal computer which translates the tones into letters on the screen. One particular adaptation, the "Lip-Reader Trainer: A Computer Program for the Hearing Impaired" (p.4) is currently being used at the Western Pennsylvania School for the Deaf in Pittsburgh. It is used to supplement training by an instructor.

The *Smithsonian Magazine* for January, 1984, contains a description of the work of two educators who are using computers with speech synthesizers to help children with severe language difficulties. One, a developmental psychologist from California, uses a touch-sensitive screen. When a child touches one of several pictures on the screen, the computer names the objects. She has had success with a young Down's syndrome child who rapidly increased his spoken vocabulary through the use of the microcomputer. The second psychologist designed a word-processing system so that the computer says each letter, word and sentence the child types. Thus, children who can talk but have great difficulty with reading and writing are able to write their own stories and to make sense out of written language.

Bull (1982) believes the computer can be effective in developing reading and writing skills. He contrasts the relative ease with which children acquire oral language with the difficulty many of these same children have with written language. The difficulty of immediate interaction between a student who writes an essay and a teacher who reads it may contribute to the problem. The computer, however, will "take turns," reacting when the RETURN or ENTER keys are pressed and indicating with a cursor the programmer's turn. Bull advocates using the LOGO language with students since it permits many activities to be accomplished with a minimum of programming skill. These activities are interesting and permit students to reach a desired goal. "The programming skills learned in the process also will be of value to both the learner and society at a later date (p. 6)."

B. Learning Disabilities and Mental Retardation

Learning-disabled students are usually of above average intelligence but have problems understanding the spoken or written word. They are characterized by short attention spans; poor motor coordination resulting in messy, often illegible written work; poor organization; and poor communication skills.

The mentally-retarded student may range from mildly mentally handicapped to severely retarded. Techniques for working with retarded students include using special

materials, being consistent, repeating, providing practice with immediate feedback, and reinforcing through praise for successfully completing tasks.

Most computer programs used in this area make use of CAI (Computer-Assisted Instruction) and CMI (Computer-Managed Instruction). Drill and practice exercises are developed with graphics and sound to provide motivation. Records are kept of students' progress. The unique capabilities of the computer are used in these programs. In mathematics software a random number generator provides a variety of problems in specified operations and gives immediate feedback as to the correctness of the answer. In a program for dyslexic students, a multisensory approach is part of the design. A light pen is used to trace over the letters on a video screen while a voice synthesizer sounds out the letter-sound combinations. This kinesthetic approach to teaching reading has been advocated for many years but rarely adopted because it requires a higher adult-to-child ratio than was possible in most schools.

Metzger, Ouellette and Thormann (1981) in *Learning Disabled Students and Computers: A Teacher's Guide Book* discuss educational software for learning-disabled (L.D.) students under Taylor's (1980) three categories; tutor, tool and tutee. While conceding that most computer use falls under the tutor category — drill and practice, simulation and games — they present arguments for including the last two categories of tool and tutee. Because most learning-disabled students have difficulty writing, use of the computer as a tool, that is, for word processing, can be a great motivator. There are no erasure holes, no broken pencil points, and no illegible handwriting. They also mention using the computer to compose music which the computer will then play. In the tutee mode, the student programs the computer rather than vice versa. The Logo language developed at the Massachusetts Institute of Technology by Papert and his associates is cited as an excellent programming language for learning-disabled students. Many projects using Logo to provide successful experiences for children with a variety of handicaps are described by Weir and associates (1981, 1982).

C. Movement, Neuromuscular and Neurological

The physically-handicapped student usually has a mind which functions normally. Modifications need to be made in the environment to accommodate the handicap. The computer has the potential to provide a myriad of opportunities for these students. In this category the *Johns Hopkins Proceedings* describe numerous adaptations of the computer for persons who are quadriplegics and brain-injured. A voice-activated motor-handicapped support system is designed to assist the handicapped or bedridden individual to use a microcomputer to meet his or her needs and to offer worthwhile job opportunities. Other adaptations include a sound-activated telephone dialing unit, a system to assist disabled persons to regain weight-shifting ability necessary for ambulation, and a cognitive therapy program to restore short-and long-term memory storage.

One of the adaptations, the "Eyetracker Communication System," which won first place in its region and second in the nation, is being used at the Rehabilitation Institute of

Pittsburgh. The sensor unit permits a selection of words by eye contact and a voice unit gives verbal responses, thus enabling a cerebral-palsied patient who could not even hold her head erect to communicate.

Other programs focus on what these students like to do, such as watch T.V., as well as what they are physically able to do. A game paddle can be adapted to provide an easily operable input device which provides the physically handicapped with the ability to exert control over the environment (Pollard, 1984). A head pointer provides access to a keyboard and permits a severely-physically handicapped student to use a word-processing program to write poetry (Reece, 1984). The headstick can also be adapted to use a touch-sensitive CRT screen for PLATO system programs as well as to use the keyboard as an input device (Johnson, 1984).

D. Vision

Students in this category may have varying degrees of sight deficiency. A functionally-blind student either has no vision or only has light perception. A legally-blind student has vision in the better eye, even with corrective lenses, no better than 20/200. That is, he or she can see at 20 feet what a person with normal vision can see at 200 feet. A partially-sighted student has vision in the better eye, even with corrective lenses, no better than 20/70. The term "visually impaired" refers to partially-sighted or functionally-blind individuals, and the term "blind" refers to a student who has complete sight loss.

The *Johns Hopkins Proceedings* include 24 applications of personal computing to aid persons with vision handicaps. These range from a musical language computer which uses tonal patterns for words and common word combinations to a braille word-processing system which enables a sighted volunteer to produce braille text rapidly and accurately. The text is displayed on the CRT screen and can be easily corrected before being transformed into an embossed copy.

The January, 1984, issue of *Educational Computer* contains a description of an adaptation which permits a blind student to perform "sophisticated chemistry experiments such as spectrophotometry, pH and pH titration (p. 29)." A multimeter functions as a thermometer, pH meter and timer and has speech output which verbalizes signs, units and decimal points. The microcomputer acts as a talking terminal (Hilldrup, 1984).

Visualtex, a manufacturer of electronic visual aids, has developed a video display which changes a microcomputer's normal video display into characters with a maximum height of 5½ inches (up to 16 times normal display height). This enables visually-impaired students to have hands-on experiences with computers.

Electronic Learning (Pollard, 1984) describes the Optacon, a device that changes printed text into vibrations which a blind person can feel on his or her finger. This device can be connected to a microcomputer enabling blind students to learn programming and word processing and to use instructional software (p. 46).

E. Other

In the *Johns Hopkins Proceedings*, the "Other" section is devoted to applications not fitting into the four preceding sections. Adaptations include aids for the deaf-blind, a plan for an electronic dictionary for the handicapped, and a design to make the standard keyboard into a custom-designed keyboard for typists with manual dexterity problems. It also describes a data base information system for the disabled currently in operation in Santa Clara, California.

VI. WHAT DOES RESEARCH TELL US ABOUT MICROCOMPUTERS?

Research on educational computing has been scarce. Maddux (1984) believes this is because, until the advent of microcomputers, researchers could not give large groups of children access to computers and because most researchers lacked expertise in educational uses of computers. Some large scale studies such as that conducted by Becker (1983) at Johns Hopkins have used questionnaires to determine how schools are using microcomputers. Other studies (Weir et al. 1981 & 1982) have been case studies or descriptions of special projects. Some have described effects on individual children (Trachtman, 1984). One such detailed study (Marquis, 1984) yielded 390 pages of ethnographic research on the very positive effects a microcomputer had on the life of a legally-blind high school student.

McLaughlin's (1984) study of teachers' use of interactive videodiscs, a federally funded project, delineates other reasons why technological innovations do not always work in schools. He identified two questions, that of teachers' need for the technology and whether it is indeed ready for school use (p. 1). At the time of his study, the software was not available for use and the assumption that teachers had the expertise and time to create interactive software proved false. However, it is clear that the need for individualized instruction for special students does exist (p. 2). It is further clear that the interactive videodisc provides a way to achieve this individualization. Myriad problems with movement and storage of equipment, lack of software, access to phone lines, etc. proved difficult to overcome. The conclusion to be drawn from this and other studies seems to be that if the new technology is to be used, a strong support system is essential to help teachers identify needs and to assist them in using the hardware and software effectively. Such a system might include computer hardware experts, school administrators, and aides or substitutes to provide release time for teachers.

Maddox (1984) suggests areas for further research. Given the limited access most students have to computers in schools, what computer activities would be most beneficial? We assume that those which improve cognitive skills through programming, word processing and simulations are more desirable than those which stress drill and practice (p. 38). We are hopeful that research will prove this assumption.

VII. COMMUNICATION NETWORKS FOR THE HANDICAPPED

HEX is the Handicapped Educational Exchange, a computerized bulletin board. It is a free service for persons involved in the education of or providing services to the handicapped to make their assistance, products or services known to a wide audience. For more information write to Richard Barth, 11523 Charlton Drive, Silver Spring, MD 20902.

Special Net is another electronic bulletin board. It provides the latest information available on educational programs and services for special educators. For additional information, write National Association of State Directors of Special Education, 1201 Sixteenth Street, N.W., Washington, D.C. 20036.

VIII. SUMMARY

It is clear that most of the nation's schools have now acquired computers. It is also clear that although software is available in quantity, much is of poor quality. Teachers and administrators should carefully define the role computers will play in their school curriculum, and then evaluate the software to determine that it meets their needs and the needs of students. After these decisions have been made, then consideration can be given to the purchase of the hardware.

Because the field is changing so rapidly, and so many school personnel are affected by decisions relating to purchases, it is recommended that schools keep abreast of developments through current periodicals and through the ongoing contributions of a representative committee. The establishment of such a committee lends itself to better decision-making and greater involvement in the acceptance and use of computers in the schools.

IX. AN ANNOTATED BIBLIOGRAPHY

This bibliography contains references which the computer workshop instructor and the participants found most helpful in providing information about using microcomputers to meet the needs of handicapped students in vocational education. Costs quoted are those paid during the 1983-84 school year. These may change.

Computer literacy: definition and survey items for assessment in schools. Washington, D.C.: Government Printing Office, 1984.

Gives questions designed to provide data for districts in assessing computer literacy and computer use in schools. Helps in making informed decisions. Developed by Educational Testing Service.

Order from: Government Printing Office
Supervisor of Documents
#065-000-00196-9
Washington, D.C. 20202
Cost: $7.00

Goldenberg, E.P. *Special technology for special children.* Baltimore: University Park Press, 1983.

Focuses on special education with an emphasis on children's needs, special children with an emphasis on various disabilities. special technology and how it can help these children develop, and contains a section on research needs. Summarizes conflicting theories of how special children learn.

Jones, N.B., & Vaughn, L. (Ed.). *Evaluation of educational software: a guide to guides.* Chelmsford, Massachusetts: Northeast Regional Exchange, 1983.

Discusses processes for making informed selections of microcomputer software, raises issues concerning the processes, presents several examples of software evaluation models and gives information on resources for those making decisions. The resource section includes books, directories, articles, clearinghouses and information centers, periodicals and reports devoted to software reviews and computer accessible databases.

Order from: Northeast Regional Exchange, Inc.
101 Mill Road
Chelmsford, MA 01824

Metzger, M., Ouellette, D., & Thormann J. *Learning disabled students and computers: a teacher's guide book.* Eugene, Oregon: 1983.

Answers the reader's questions about the applications of microcomputers with learning-disabled (L.D.) students. Describes characteristics of L.D. students and discusses how the computer can help them overcome some learning difficulties. The reference section includes periodicals, books, organizations, networks, research centers and bibliographies.

Order from: International Council for Computers in Education
135 Education
University of Oregon
Eugene, OR 97403
Cost: $2.50

Nave, G., Browning, P., & Carter, J. *Computer technology for the handicapped in special education and rehabilitation: a resource guide.* Eugene, OR: International Council for Computers in Education, 1983.

Contains an annotated bibliography with 199 citations cross-referenced by author(s), topic areas, periodicals and disabilities. Designed to acquaint the reader with the contributions computer technology can make in improving the lives of handicapped individuals.

Order from: International Council for Computers in Education
135 Education
University of Oregon
Eugene, OR 97403
Cost: $7.00

The Institute of Electrical and Electronics Engineers, Inc. *Proceedings of the Johns Hopkins first national search for applications of personal computing to aid the handicapped.* Piscataway, New Jersey: IEEE, 1981.

Contains abstracts of software and hardware adaptations for handicapped users of microcomputers. Grouped under five handicap categories.

Order from: IEEE Service Center
445 Hoes Lane
Piscataway, NJ 08854

Pitts, M.R. *The educator's unauthorized microcomputer survival guide.* Washington, D.C.: Council for Education Development and Research, 1983.

Contains practical information for educators who must make decisions about computers. Describes ways computers can be used and how to select appropriate software and hardware.

Order from: Council for Educational Development and Research
1518 K Street, N.W.
Suite 206
Washington, D.C. 20005

The Softworks. Pittsburgh, Pennsylvania: Allegheny Intermediate Unit, 1984.

Compilation of software evaluations from journals, periodicals, newsletters, and other sources.

Gives title, company producing product and address, subject area, grade level(s) for which appropriate, hardware requirements, cost, description, evaluation and source of evaluation.

Available to school districts belonging to The Allegheny Intermediate Unit, 200 Commerce Court Building, Pittsburgh, PA 15219.

Tindall, L.S. & Gugerty, J. J. *Effective microcomputer-assisted instruction for the vocational education of special needs students.* Vocational Studies Center, School of Education, University of Wisconsin-Madison, 1983.

Part I — Lists microcomputer programs which practitioners have found helpful in working with special needs students. Includes make and model of computer which uses the software, whether it is for sale and the price if available, developer, contact person, areas of vocational education for which it is applicable, disability of student for which it is appropriate, program format, description, and modifications needed for special populations.

Part II — Describes educational uses of microcomputers in a variety of settings.

Cross-referenced by curricular area and brand of microcomputer.

Available from: The Vocational Studies Center
University of Wisconsin at Madison
Publications Unit
964 Educational Sciences Building
1025 W. Johnson Street
Madison, WI 53706
Cost: $25.00

Zahniser, G., Long, J. & Nasman, L. *An administrator's guide to microcomputer resources.* Columbus, OH: The National Center for Research in Vocational Education, 1983.

Identifies resources (articles, magazines and other publications) for selecting hardware, inservice training and software evaluation. Lists of periodicals and journals, organizations, and software vendors are included as is an extensive annotated bibliography on all aspects of microcomputers in education.

Order from: The National Center for Research
in Vocational Education
National Center Publications, Box F
1960 Kenny road
Columbus, OH 43210
Cost: $9.50

Zahniser, G., Long, J. & Nasman, L. *Microcomputers in vocational education: a decision guide.* Columbus, OH: The National Center for Research in Vocational Education, 1983.

Presents opinions of experts in microcomputer technology and its applications to vocational and technical education as well as a review of the literature. Chapter I identifies issues and describes three possible views of the uses of microcomputers. Chapter II describes the need to respond to the new technology with curricular changes. Chapter III deals with CAI (computer-assisted instruction) problems and potential. Chapter IV deals with CMI (computer-managed instruction). Chapter V describes administrative uses of micros. Chapter VI describes videotape and videodisc technology as it relates to microcomputers. Chapter VII is a summary and list of recommendations. The Appendix is a glossary of microcomputer terminology and the list of References are helpful to readers who wish additional information on the topics covered in the booklet.

Order from: The National Center for Research in
Vocational Education
National Center Publications, Box F
1960 Kenny Road
Columbus, OH 43210
Cost: $8.75

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What is computer literacy? *E.T.S. Developments,* Spring 1984, 9.

EVALUATION
VOC. ED. COMPUTER LITERACY WORKSHOPS

Session Attended _____
Previous Level of Computer Literacy **None** _____
Some _____
High _____

1.	**The organization was:**	**Excellent** 5	4	3	2	**Poor** 1
	Comments:						
2.	**The objectives of the workshop were:**	**Clearly Evident** 5	4	3	2	**Vague** 1
	Comments:						
3.	**The presenter was;**	**Excellent** 5	4	3	2	**Poor** 1
	Comments:						
4.	**The presentations were:**	**Very Informative** 5	4	3	2	**Not Helpful** 1
	Comments:						
5.	**The Hands-on activities were:**	**Very Interesting** 5	4	3	2	**Dull** 1
	Comments:						
6.	**The handouts were:**	**Very Helpful** 5	4	3	2	**No Benefit** 1
	Comments:						

Please summarize what you consider to have been the strengths of these workshops.

Please make suggestions for changing future workshops.